# A biomathematical model of lymphopoiesis and its application to acute and chronic irradiation assessment

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After the events of September 11, 2001, there is an increasing concern of the occurrence of radiological terrorism that may result in significant casualties in densely populated areas. Much effort has been made to establish various biomarkers to rapidly assess radiation dose in mass-casualty and population-monitoring scenarios, which are demanded for effective medical management and treatment of the exposed victims. Among these the count of lymphocytes in peripheral blood and their depletion kinetics are the most important early indicators of the severity of the radiation injury. In this study, we examine a biomathematical model of lymphopoiesis which has been successfully utilized to simulate and interpret experimental data of acute and chronic irradiations on rodents [1]. With revised parameters for humans, we find this model can reproduce several sets of clinical lymphocyte data of accident victims over a wide range of absorbed doses. In addition, the absolute lymphocyte counts and the depletion rate constants calculated by this model also show good correlation with the Guskova formula and the Goans model, the two empirical tools which have been widely recognized for early estimation of the exposed dose after radiation accidents [2]. We also use the model to analyze the hematological data of the Techa River residents which were exposed to chronic low-dose irradiation during 1950-1956 [3]. This model can serve as a computational tool in radiation accident management, military operations involving nuclear warfare, radiation therapy, and space radiation risk assessment.

References:

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